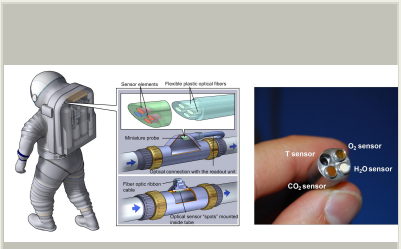
Small Business Innovation Research/Small Business Tech Transfer

Miniature Sensor Probe for O2, CO2, and H2O Monitoring in Space Suits, Phase II

Completed Technology Project (2013 - 2015)

Project Introduction

Advanced space suits require lightweight, low-power, durable sensors for monitoring critical life support materials. No current compact sensors have the tolerance for liquid water that is specifically required for next-generation portable life support systems (PLSS). Intelligent Optical Systems (IOS) is developing a luminescence-based optical sensor probe to monitor carbon dioxide, oxygen, and humidity. Our monitor will incorporate robust CO2, O2, and H2O partial pressure sensors interrogated by a compact, low-power optoelectronic unit. The sensors will not only tolerate liquid water but will actually operate while wet, and can be remotely connected to electronic circuitry by an optical fiber cable immune to electromagnetic interference. For space systems, using these miniature sensor elements with remote optoelectronics provides unmatched design flexibility for measurements in highly constrained volume systems such as PLSS. Our flow-through monitor design includes an optical sensor we have already developed for PLSS humidity monitoring, and an optical oxygen sensor with similar IOS technology. In Phase I of this project IOS demonstrated a CO2 sensor capable of operating while wet, and a miniature prototype PPCO2-H2O-O2 sensor probe was fabricated and tested under relevant environmental conditions. In Phase II, in collaboration with Hamilton Sundstrand (Hamilton), we will design and produce prototypes for space qualification, and will conduct extensive testing under simulated space conditions, culminating in validation in NASA systems, bringing the monitor to TRL 6-7. Engineers from IOS and Hamilton will design the new sensor system to be compatible with electronics developed and fabricated for space operation by Hamilton (in particular, the common modular data bus interface unit). This approach will minimize the power requirements and size of the monitoring device, and will tremendously facilitate the infusion of the technology into the PLSS.



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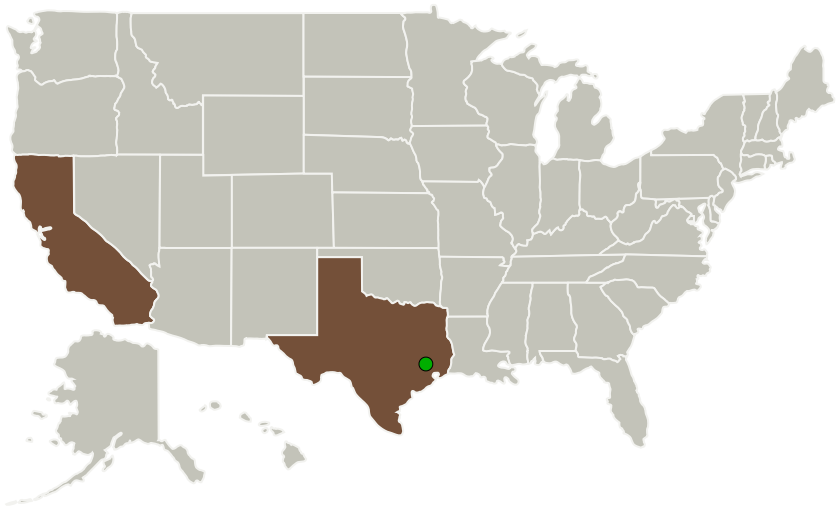
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Intelligent Optical Systems, Inc.	Lead Organization	Industry	Torrance, California
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations	
California	Texas

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Intelligent Optical Systems, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Jesus D Alonso

Co-Investigator:

Jesus Delgado Alonso

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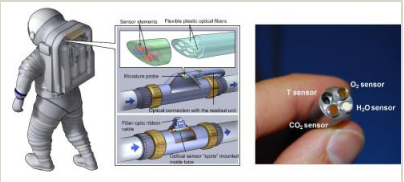
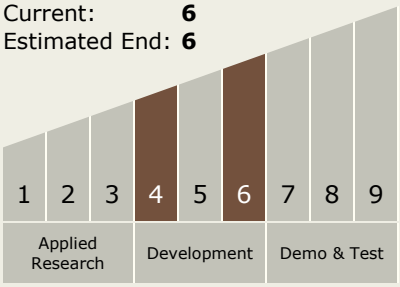
Images



Project Image
Miniature Sensor Probe for O2, CO2, and H2O Monitoring in Space Suits
(https://techport.nasa.gov/image/126511)

Technology Maturity (TRL)

Start: **4**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.2 Extravehicular Activity Systems
    - TX06.2.2 Portable Life Support System

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System